

## CLAIMS

1. A bipolar transistor, comprising:

5 a first semiconductor layer to be a collector layer formed on a substrate and including an impurity of a first conductive type;

a second semiconductor layer to be a base layer formed on said first semiconductor layer and including an impurity of a second conductive type;

10 a third semiconductor layer formed on said second semiconductor layer from a material having a bandgap different from a bandgap of said second semiconductor layer;

an insulator film provided on said third semiconductor layer;

15 an opening portion formed through said insulator film to reach said third semiconductor layer; and

an emitter connecting electrode made of a conductor material and brought into contact with said third semiconductor layer by filling said opening portion in said  
20 insulator film,

wherein said third semiconductor layer includes an emitter diffusion layer of the first conductive type positioned below said opening portion, and a peripheral layer including the impurity of the second conductive type at least  
25 in an upper part thereof at a region located at a side of said emitter diffusion layer.

2. The bipolar transistor according to claim 1,

wherein:

said insulator film is formed from a silicon dioxide film doped with the impurity of the second conductive type; and

5       the impurity of the second conductive type included in at least a part of the top portion of said third semiconductor layer is the impurity of the second conductive type out-diffused from said insulator film.

10       3. The bipolar transistor according to claim 1, further comprising:

15       a polysilicon film, doped with the impurity of the second conductive type and provided so as to contact said third semiconductor layer at a portion located outside of said underlying insulator film and to extend over said insulator film, for functioning as a base connecting electrode,

20       wherein the impurity of the second conductive type included in at least a part of the top portion of said third semiconductor layer is the impurity of the second conductive type out-diffused from said polysilicon film by passing through said insulator film.

25       4. The bipolar transistor according to any one of claims 1 through 3, wherein the impurity of the first conductive type in the emitter diffusion layer of said third semiconductor layer is the impurity of the first conductive type out-diffused from said emitter connecting electrode.

5. The bipolar transistor according to any one of

claims 1 through 4, wherein:

said substrate is a silicon substrate;

said first semiconductor layer is an Si layer;

said second semiconductor layer is an SiGe layer or an

5 SiGeC layer; and

said third semiconductor layer is an Si layer.

6. A fabrication method of a bipolar transistor,  
comprising:

10 a step (a) of forming a second semiconductor layer to  
be a base layer including a second conductive type impurity  
on a first semiconductor layer that is formed on a substrate  
to be a collector layer including a first conductive type  
impurity;

15 a step (b) of forming, on said second semiconductor  
layer, a third semiconductor layer, including the second  
conductive type impurity at least at an upper part thereof,  
through epitaxial growth from a material having a bandgap  
different from a bandgap of said second semiconductor layer;

20 a step (c) of depositing an insulator film on said  
substrate after said step (b);

a step (d) of forming an opening portion through said  
insulator film to reach said third semiconductor layer; and

25 a step (e) of forming an emitter diffusion layer in  
said third semiconductor layer at a region positioned below  
said opening portion by introducing the first conductive type  
impurity.

7. A fabrication method of a bipolar transistor,

comprising:

5 a step (a) of forming a second semiconductor layer to be a base layer including a second conductive type impurity on a first semiconductor layer that is formed on a substrate to be a collector layer including a first conductive type impurity;

10 a step (b) of forming, on said second semiconductor layer, a third semiconductor layer through epitaxial growth from a material having a bandgap different from a bandgap of said second semiconductor layer;

a step (c) of depositing an insulator film including the second conductive type impurity on said substrate after said step (b);

15 a step (d) of forming an opening portion through said insulator film to reach said third semiconductor layer; and

a step (e) of forming an emitter diffusion layer in said third semiconductor layer at a region positioned below said opening portion by introducing the first conductive type impurity,

20 wherein the second conductive type impurity is doped into a top portion of said third semiconductor layer from said insulator film by treatments after said step (c).

8. A fabrication method of a bipolar transistor, comprising:

25 a step (a) of forming a second semiconductor layer to be a base layer including a second conductive type impurity on a first semiconductor layer that is formed on a substrate

to be a collector layer including a first conductive type impurity;

5 a step (b) of forming, on said second semiconductor layer, a third semiconductor layer through epitaxial growth from a material having a bandgap different from a bandgap of said second semiconductor layer;

a step (c) of depositing an insulator film on said substrate after said step (b);

10 a step (d) of depositing a conductor film including the second conductive type impurity on said substrate and forming an opening portion through said conductor film to reach said insulator film;

15 a step (e) of forming a sidewall made of an insulating material for covering a side surface of the opening portion in said first conductor film;

a step (f) of forming an opening portion through said insulator film to reach said third semiconductor layer after said step (e); and

20 a step (g) of forming an emitter diffusion layer in said third semiconductor layer at a region located below the opening portion by introducing the first conductive type impurity,

25 wherein the second conductive type impurity is doped into an upper part of said third semiconductor layer from said conductor film by passing through said insulator film by treatments after said step (d).

9. The fabrication method of a bipolar transistor

according to claim 8, further comprising:

a step of depositing, on said substrate, another conductor film different from said conductor film, and then patterning said another conductor film to form an emitter

5 connecting electrode including the first conductive type impurity in such a manner so as to fill in the opening portion in said insulator film and to extend over said insulator film, said step following said step (f) and preceding said step (g).

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